

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001



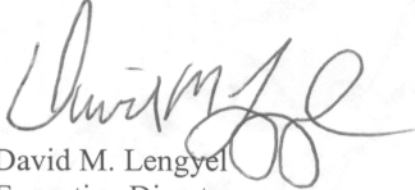
March 15, 2002


Reply to Attn of:

Q-1

Memorandum for the Record

Pursuant to the provisions of the Federal Advisory Committee Act (Public Law 92-463, October 6, 1972) and NASA Policy Directive 1150.21, entitled "Establishment, Operation and Duration of NASA Advisory Committees," the enclosed minutes of the Aerospace Safety Advisory Panel's Annual Meeting conducted on March 7, 2002, at NASA Headquarters, are submitted for the record.


David M. Lengyel
Executive Director
Aerospace Safety Advisory Panel


Richard D. Blomberg
Chair
Aerospace Safety Advisory Panel

2 Enclosures:

1. Meeting Minutes
2. Attendance Log

Aerospace Safety Advisory Panel (ASAP)
Annual Meeting
March 7, 2002
NASA Headquarters
Room 9H40, Program Review Center

Introduction:

Executive Director and Designated Federal Officer, David Lengyel welcomed the ASAP to its annual Public Meeting and provided a brief history of its members. The panel was established in 1968 in response to the Apollo 12 launch pad fire, and focuses its attention on safety issues involving human space flight programs. The annual meeting culminated an evaluative process involving 50-60 visits to NASA contractors and centers, resulting in an Annual Report for the year 2001. The meeting format was described as a structured presentation of ASAP's twenty findings and recommendations, as well as ancillary subjects, each addressed by specific panel members and followed by brief discussion.

ASAP Chair, Mr. Richard Blomberg opened the discussion by noting the recent addition of new panel members and consultants, including Admiral Paul Reason, Mr. Richard Bruckman, Dr. Bernard Harris, and Dr. Wanda Austin, who were not present. The meeting and associated annual report is a culmination of a year's worth of fact-finding. The Appendix of the Annual Report contains details and chronology of meetings that have taken place over the year, representing high-priority and open issues that may best be handled at the level of the NASA Administrator. Mr. Blomberg commented that 2001 was one of the smoothest years ever, despite budgetary issues and the events of September 11, and expressed deep appreciation for all assistance received. In order to highlight their importance, a new section describing pivotal and overriding issues was noted to have been added to the front of the annual report.

Planning Horizon and Budgets

Finding/Recommendation # 1:

Last year, concern arose that the planning horizon for the Space Shuttle (SS) and International Space Station (ISS) programs was too short, imperiling the development, advancement, and adaptation of safety improvements. It is now recognized that the SS will be used well beyond 2012, a longer life span than was initially anticipated. Serious safety concerns are currently ranged around the potential for lost opportunities in safety improvements, which can lead to safety problems as aging systems deteriorate. The Panel believes that the SS is fully capable of supporting ISS for its entire life, and has more potential beyond this task. Already engineered developments, as well as those in current development, can and must be implemented. At present, in the area of propulsion and materials, there is not enough available technology to support the development of a radically new vehicle that would be significantly more capable than the SS. Now is the

time to make the investment in ensuring long-term safety. Future safety is being compromised by allowing more time to lag before necessary improvements are undertaken. Lt. Gen. Forrest McCartney concurred, adding the comment that the useful life of the space shuttle system is tied to its safety. Mr. Blomberg replied that safety will erode further if improvements are not begun now, citing the severe neglect of ground infrastructure and launch pads as one example.

NASA Administrator, the Honorable Sean O' Keefe, commented on a recommendation concerning the upgrade and revitalization of SS and ISS; the essence of this recommendation illustrates that it is imperative for NASA as an institution to consider alternate scenarios and substitutions to address safety of flight, particularly if planned upgrades are to be deferred or eliminated. NASA's ground infrastructure and workforce all exist in a broader context - addressing them singly is not a way to attack systemic problems. NASA has been asked to evaluate excursions out to 2012 and to produce space launch alternatives, independent of other program initiatives. The expert panel was asked for its specific recommendations concerning modifications, upgrades, and service life extension programs in such a manner as would inform agency debate. How can operations be sustained in a safe manner? Strategic management of human capital, infrastructure, and organizational questions must also be addressed. The space program is a complex system not unlike nuclear propulsion science; Mr. O'Keefe's background in this area is reminiscent of the NASA atmosphere, where safety is also a paramount value in the organizational culture. No amount of time in thinking about these questions is lost - the continual pondering of safety and how to improve it underpins the credibility of the institution. The ASAP is focusing on the right issues; NASA is grateful for the Panel's very thoughtful consideration and its extraordinary public service. NASA is striving to maintain at least the same level of safety, and there ought to be a commitment to continuous improvement over the current safety regime. It is necessary to look at these issues in a systemic way, and seek to implement the spirit and letter of the Panel's findings and recommendations.

Mr. Blomberg turned to Finding 2 (Upgrades) and remarked that these are unfortunate semantics describing warranted safety improvements that reduce risks and maintain the safety of space vehicles and recommended retaining as many upgrades as possible.

Upgrades

Finding/Recommendation #2:

Mr. Sidney Gutierrez commented that the crew escape system, currently the subject of an ongoing study, is the single best way to improve *crew* safety. NASA should document the rationale for flight without such a system and also announce a date on which such a system would be available. A pertinent question to consider is: if we were building a

Space shuttle today, would we omit a crew escape system? An additional question to carefully consider is: when can upgrades be omitted? To answer this question, NASA must analyze logistics needs of the vehicle and select the ones that best sustain the vehicle—some upgrades have long lead times, some were to be provided by companies that no longer exist. NASA needs to recognize and take into account that this is a long planning process. Mr. O’Keefe added that NASA must think about how to priority-rank the issues and that a situation will inevitably arise that will make upgrades appear more or less attractive. There will be a point at which, depending upon the service life of a system, one needs to decide whether to upgrade old systems or replace them completely. For near-term shuttle orbiter operations, NASA must think about planning horizons and permutations of service capacity- there may be changes. Match up these possibilities with the best scenarios.

Infrastructure

Finding/Recommendation # 3:

Test Equipment

Mr. Robert Sieck acknowledged that aging facilities present a national problem. NASA owns most of its equipment and infrastructure, and these need revitalization. There are no immediate safety concerns- these are continually monitored and resolved as they occur. However, a long backlog is developing, and NASA is losing ground. The contract structure does not motivate corporations to agree to long-term commitments for improvement. This problem lends itself to a supportability issue. Temporary fixes or the deferment of a permanent fix have led to safety issues. More will occur if recommendation 3 is not followed.

Mr. O’Keefe commented that, in most private settings, there are important natural motivating factors surrounding investment decisions. The private business philosophy dictates that corporations can shut down what does not work. The public sector cannot do this, presenting an unfavorable competitive disadvantage. NASA can keep infrastructure moving to the right; NASA must think about how to procedurally, within the federal context, provide motivations and incentives to contractors to keep infrastructure in good repair. NASA needs to move beyond historically mandated or outmoded thinking.

Finding/Recommendation # 4:

Training and Test Facilities

Currently, training and test facilities are meeting requirements. Each and every facility has been challenged by a strategic service review, wherein needs analysis and critical skills retention are among issues under scrutiny. These will be reviewed next year.

Space Shuttle Privatization

Finding/Recommendation # 5:

Mr. Blomberg commented that privatization could have safety implications, especially in the transition period from government to private responsibility. NASA should build upon this consideration- that NASA must maintain an independent safety focus to ensure nothing “falls through the cracks.”

Mr. O’ Keefe commented that this is a chance to look at the efficacy of natural corporate motivations for efficiency and productivity and likened the process to a concentration on capital investment portfolios; privatization may improve productivity, efficiency, and safety by building the incentives into the system. NASA should carefully consider possible advantages of privatization. He concurred that the transition of professionals needs to be watched for skill level maintenance.

Workforce and Critical Skills

Finding/Recommendation #6:

Ms. Shirley McCarty addressed the long-term focus on workforce issues—highly skilled workers with the right balance of experience keep NASA safe. Competition for hiring is keen. As an example, Lockheed-Martin is currently looking for thousands of IT professionals to support its Joint-Strike Fighter contract. Similarly, NASA needs to ensure availability of skilled professionals. ASAP will watch current workplace activity with great interest and keep an eye on the Boeing transition as well.

Mr. O’Keefe commented that the National Academy of Public Administration released a study two years ago, focusing on this question of skill mixes and critical skill requirements. NASA is looking at their recommendations and ASAP should do the same. The study has specific applications to technical organizations such as NASA.

Mishap Investigation

Finding/Recommendation #7 and #8:

Mr. Robert Francis noted that under this heading, the recommendations are narrowly drawn, but are a function of what the Panel has done in the last year. NASA’s mishap investigation process raises a question of professionalism and independence and highlights the perils of investigating oneself. NASA should try to move away from self-investigation. ASAP saw some signs of progress in this direction. Professional

assistance can allow NASA to implement more preemptive activities, such as those being used in such areas as aviation, i.e., self-reporting, using recorders, etc. are the parallels in aviation. Is confidential self-reporting uncomfortable for NASA?

Mr. O’Keefe replied that the concept of a Board of Inquiry that is independent of organization or incident is more of what NASA has in mind as an approach to this area of concern, and agreed that an external view of these cases is necessary. The act of preparing for disaster becomes the best way to avoid it. Mr. Francis acknowledged that the ASRS program marked NASA as a pioneer in this respect.

Mr. O’Keefe commented that NASA can obtain a sense of best practices from benchmark institutions, and should also use the continuous improvement commitment, and must not rest on historical record. Mr. Blomberg added that NASA needs experts outside the agency to help investigate mishaps.

Space Shuttle Program

Space Shuttle

Finding/Recommendation #9:

Cockpit Avionics Upgrade

Mr. Gutierrez commented that the SS cockpit display was obsolete when it was installed. The Panel highly recommends the current upgrade program, including enhancements in situational awareness and performance that will also improve safety.

Finding/Recommendation #10:

Wiring

Mr. Sieck reiterated that there is always a requirement for redundancy and separate circuit paths in vehicle wiring. When shuttle Columbia had a significant electrical event in the recent past, design redundancy helped to save this mission. It is important to separate critical circuits, and also to train maintenance and overhaul personnel to avoid damaging these circuits. The panel means to keep the heat on this recommendation. Mr. O’Keefe commented that before STS-109, he attended a flight readiness review and received quite an education, and was suitably impressed at the level of detail that the ground crew considered in the preflight period. The level of attention and diligence was exceedingly high.

Finding/Recommendation #11:

Excessive EOs

Mr. Kenneth Englar remarked that Finding 11 is carryover from last year. Approximately 1500 engineering drawings had numerous unincorporated changes, an unacceptable state of affairs (5 changes at most are acceptable in the industry- about 20 changes per drawing were found at NASA). The problem lies in the fact that the personnel have difficulty in interpreting the engineering drawing. Boeing hardware has had the biggest problems, and has not yet responded to this recommendation.

Mr. O'Keefe commented that as one "freeze-frames" engineering drawings, one preordains block obsolescence. Unincorporated EOs are a question of diligence, which is the essence of the problem.

Mr. Englar replied that what is there ought to be reflected on the drawing- if one does not transfer personnel along with the drawings, the necessary changes are lost. Mr. O' Keefe noted that the recommendation must be carefully articulated in order to reflect the true problem; the message should not be translated to signify "no changes ever!" A panel member commented that the problem is a configuration management issue. If drawings were digitized, changes would be easier to incorporate. Dr. George Gleghorn added that digitizing would be more costly.

Finding/Recommendation #12:

Mobile Vendor Force

Mr. Sieck observed that logistics (shuttle) does very well considering the uniqueness of its components and many different component sources. However, in the long term, some inventory is close to zero balance. Many people are changing places of employment and companies are being merged. Vendors must appreciate the criticality of their products- for instance; the solid rocket motor chemical is part of a much larger recipe that can affect the safety of the flight. NASA must apply due diligence- perform the audits and inspections and keep attention high.

Mr. O'Keefe added that this is a quintessential example of the serious challenge of running a unique organization. NASA can't be a corporation- can't go on to the next product line. There are minimal comparative cases in private business. A unique product for which there is no other use can be terribly expensive to maintain. There is no substitute for this and it is a very interesting challenge. NASA's challenges defy normal corporate evolution. The organization has always swum upstream on this issue.

Ms. McCarty commented that planned IT obsolescence is a parallel case. Private corporations are compelled to replace their systems every two years, with the caveat that the new system may not be compatible with the old one.

Space Shuttle Program

Space Shuttle Processing

Finding/Recommendation #13 and #14

NASA's original plan, Orbiter Maintenance and Down Period (OMDP), was to inspect, but to defer major modifications. Now, full OMMs are planned at KSC.

Lt. Gen. McCartney commented that the regular workforce is acceptable for both routine processing and OMMs. However, OMMs and OMDPs require heavier maintenance to get the vehicles back to their previous pristine condition. ASAP recommends that separate management teams be implemented for each type of activity as the basic underlying philosophies are different..

Mr. O'Keefe warned against lack of communication between the two teams.

Lt. Gen. McCartney clarified that the same engineering and technician pools could be retained, but with different management teams in place. Ms. McCarty commented that "they are us," that is to say, the two management teams will therefore be forced to talk to each other.

ISS and CRV

Finding/Recommendation #15-#18

Dr. Gleghorn observed that in late 2000, damage detection, assessment, and control system was finally implemented by NASA, an action for which NASA is to be commended. A potentially worrisome design problem was noted in a review in the space station mock-up—it is difficult to locate penetrations or fires. The shell of the station is not readily visible, largely hidden by experiment racks. Probes would be needed to detect smoke or heat, a solution that seems awkward. Communication and instrumentation need to be improved. When the panel examined the fully expanded station, it was apparent that there was no way to communicate by voice; there is much room for improvement in this situation. Mr. Blomberg noted that communication is all hard-wired; station inhabitants would need to drag cable. Wireless communication should be considered. Dr. Gleghorn added that current repair kits are stocked for short duration missions; these need to be modified to accommodate long-term missions.

There are also detailed instructions in how to respond to fires, penetrations, and decompression, but there are no protocols for combined events. In addition, some alarms are inhibited during activities that falsely trip smoke alarms; currently there is no system that alerts crew to the fact that alarms have been inactivated. Alternatives may be a reminder that an alarm has been inhibited or an automated alarm system that automatically resumes surveillance after a given period.

Finding/Recommendation #17:

NASA is looking at the CRV program closely. It is plain that the CRV program is coming to an end. What is the follow-on to this? Is the follow-on Soyuz? How many will NASA need? Time may run out on this decision.

Mr. Gregory commented that two independent groups are looking at the safe haven issue for crews. Dr. Gleghorn indicated that the panel is skeptical of safe havens, they present the same problems as other alternatives. Penetration is always a potential problem. Safe havens also do not address the issue of a sick or injured crew member who needs to be evacuated to earth hastily. Mr. Blomberg noted that the ACRV study contains several good analyses of this problem.

Finding/Recommendation #18:

Dr. Gleghorn remarked that funding for orbital debris modeling efforts is zeroed out by October 2002. Nonetheless, this useful function should be maintained. NASA ought to examine a way to maintain a core capability to understand and keep track of orbital debris. Did this disappear from one part of the budget into another?

Cross-Program Areas

Finding/Recommendation #19 and #20:

Ms. McCarty noted that there has been a focus on security for several years. NASA has instituted new technologies and standards to maintain a secure system. There are further plans to run penetration exercises to illuminate areas of vulnerability, especially on critical missions. More robust data encryption is planned. The panel recommends accelerated action on both firewalls and encryption. In April 2001, a computer failure that was traced to a shoddy disk caused a significant communication failure on a shuttle mission. This event indicates a need for a more robust system, especially for fully loaded missions. NASA must evaluate architecture and look for opportunities to increase robustness, both to avoid future problems and to accommodate heavier loads. Dr. Nancy Leveson added that aging problems are accelerating at a greater pace and that NASA needs to take advantage of lessons learned. Mr. Arthur Zygielbaum commented that software has been forced to become increasingly clever and complex to function in aging systems, which adversely impacts safety.

Aerospace Technology

Mr. Schaufele noted that there were no specific findings and recommendations in this area, but that fact-finding visits have revealed encouraging progress in aviation safety programs. A new effort—an aviation system advanced research initiative—has as its goal the acceleration of air traffic management technologies that have been identified to improve the reliability of system. This is a very long-term activity. FAA and users are involved as well.

Extravehicular Activity (EVA)

Mr. Gutierrez pronounced the EVA program to be in good shape, and an example of a program that has undergone a paradigm shift. It has been able to get by with fewer assets and in spite of budget constraints. The current suit is a good one, however there is no future suit in planning, and no research and development to this end is currently planned. This raises concerns about the future well-being of this program. NASA needs to establish a timeframe on how to drive decisions in this program. Mr. Blomberg concurred that EVA is going to be an issue in ISS and future excursions, and needs to be examined.

Crew and Occupational Health

Medical operations and occupational health, and specific medical issues such as the pre-breathe protocol have finally been reviewed by Dr. Bernard Harris, and pronounced as satisfactory.

Conclusion

Mr. Blomberg announced his departure from the panel on April 1, 2002, and expressed deep gratitude to all ASAP consultants and staff members, while urging the panel and NASA to continue their collaboration. Over the years, initial tensions between the panel and the agency have been reduced; the interaction has matured into a productive give-and-take relationship. Upcoming years will be challenging for NASA as it contends with aging vehicles and an aging workforce. It may experience failure modes that have not been previously anticipated. Confidence was expressed that ASAP will continue to contribute to NASA in the face of increasing challenges. Ms. McCarty has been elected chairperson-designate of the ASAP and Lt. Gen. McCartney deputy chair-designate.

Mr. Gregory - The ASAP is core of the agency's success. NASA invites much more aggressive participation to address the continuing challenge. All the findings and recommendations are very appropriate; no areas of disagreement are seen. NASA will respond in a timely manner.

Panel Members/Attendees

The Honorable Sean O’Keefe, NASA Administrator

Mr. Kenneth Englar

Mr. Robert Sieck

Mr. Sid Gutierrez

Mr. Otto Goetz

Dr. Nancy Leveson

Ms. Shirley McCarty

Dr. Dan Mulville

Mr. Richard Blomberg

Mr. Arthur Zygielbaum

Dr. George Gleghorn

Mr. Roger Schaufele

Dr. Ulf Goranson

Hon. Robert Francis

Mr. Forrest McCartney

Mr. C. Julian May